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THE VALUE OF PHENOLSULPHONETHALEIN IN ESTIMATING THE FUNCTIONAL EFFICIENCY OF THE KIDNEYS¹

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THE purpose of this paper is to present before you for consideration some clinical observations with one of the more recent methods of determining the efficiency of the kidneys, and by manner of introduction reference will be made to some of the more important methods heretofore devised.

When we take into consideration that the exact phenomenon involved and the process of excretion by the kidneys is still a matter of more or less speculation, an attempt to establish an index of their work is accompanied with difficulties. A routine chemical microscopical and bacteriological examination of the urine usually reveals the presence of disease of the kidney. The X-ray may reveal changes in its contour, or the presence of calculi. With the cystoscope and ureteral catheters we may be able to establish the presence of disease in one or both kidneys. These methods, however, afford no definite information as to the extent of the pathological process under consideration, nor the functioning capacity of the kidney. To the surgeon confronted with the necessity of operating, particularly where the removal of a kidney may become necessary, it is a question of first importance whether the other kidney present is capable of sustaining life.

Many methods have been elaborated upon for estimating the sufficiency of the kidneys, and by these means the mortality of operation on the kidneys has been greatly reduced.

The methods of estimating quantitatively the metabolism in the body requires prolonged research with special laboratory facilities and is therefore practical only in exceptional cases.

The manner of obtaining the molecular concentration of the total solids excreted in the urine by cryoscopy, as elaborated by Koranyi, may be used as a supplementary test. The results of the cryoscopy are influenced by so many factors that errors from its use have now brought the method into disfavor.

The electrical conductivity test introduced by Dawson Turner determines the amount of mineral content of the urine. It is an estimation in ohms of the resistance, and is dependent upon the ions in the solution. The complicated and expensive apparatus and the errors which may arise during its use, in the absence of an accurate knowledge of the diet and water intake, render this test impracticable for general use.

The method of chromocystoscopy, that is to say, the administration by mouth, or preferably subcutaneously, coloring matters such as are readily excreted by the kidneys, is of greater or less practical value. It serves at least in localizing the ureteral orifices.

Methylene blue was introduced for this purpose by Archard and Castaigne. The drug is given by mouth in one-quarter grain doses, or preferably fifteen minims of a 5 per cent solution is administered by hypodermic injection. In health the drug will dye the urine in about one-half hour, while in the presence of disease of the kidneys this is delayed. Methylene blue is of little value however in estimating the functioning capacity of the kidneys, because it is slowly eliminated, and therefore requires observation for a long period of time. It has been estimated that only about 50 per cent of the drug is excreted normally in the urine. It does not lend itself, moreover, to accurate colorimetric estimation.

Indigocarmine was first used by Haidenhein in his investigation of the physiology of the kidneys, who showed that this drug was excreted by the epithelial cells of the convoluted tubules. Voelcher and Joseph, assistants of Czerny of Heidelberg, proposed the use of this dye for the purpose of testing the renal function. After an intramuscular injection of 20 cc. of a 4-10 per cent solution, the drug should appear in the urine of a healthy individual in less than one half an hour, and is delayed in the presence of disease. The delay of its appearance and the diminished in-

¹ Read before the stated meeting of the Genito-Urinary Section of the New York Academy of Medicine, November 16, 1910.

tensity of the colors of the stream ejaculated from the ureters as revealed by the cystoscope is supposed to afford an estimation of the relative amount of destruction of the secreting epithelium of the convoluted tubules. This dye has the advantage of being more readily eliminated than methylene blue, but has the decided disadvantage of being decolorized by purulent alkaline urine. It does not lend itself to colorimetric estimation, and only about 25 per cent is eliminated by the kidneys.

Rosaniline (rosaniline trisulphate of soda), first introduced by Lapine, has not attained any popularity. One cc. of a one per cent solution injected subcutaneously, usually makes its appearance in less than one-half hour. From 65 to 95 per cent is recovered in 24 hours.

Alberann's polyuria test is based upon the principle that the greater the destruction of epithelium in the kidney the less likely will that organ respond to an increase in secretion after the administration of quantities of water. This is fallacious, to be depended upon alone. This would be very helpful were it true that the secretion of the fluid contents of the urine were dependent upon the tubular epithelium alone. But that is not the case. It has been repeatedly shown that the fluid portion, together with some of the salts both organic and inorganic, are secreted by the glomeruli. It is now well known that a kidney practically devoid of tubular epithelium, such as is frequently encountered in advanced cases of interstitial nephritis, is capable of eliminating almost unlimited quantities of fluid. In such instances the polyuria test could be no index whatsoever of the kidney's efficiency to maintain life.

The phloridzin test championed by Casper and Richter is based upon a peculiar property of phloridzin discovered by Von Mehring, by virtue of which a glycosuria is produced after a subcutaneous injection of 5 mg. of a freshly prepared aqueous solution. In course of twenty to thirty minutes, after an injection into a healthy individual, glucose can be demonstrated in the urine. The relative delay and diminished quantity of sugar excreted within a certain time, say two or three hours, is supposed to afford an index of the extent of destruction of the secreting portion of the kidney. This test has now become unpopular on account of its unreliability. Instances are cited where glycosuria was not produced at all in healthy individuals after its administration. This irregularity of action may be due to other influences than those resident in the kidney. Work recently done by Schwartz in Paltauf's

institute in Vienna goes to show that the function of the adrenals plays an important rôle in the production of glycosuria by phloridzin. For example, the total extirpation of the adrenals (an experiment which is perfectly feasible in male rats) prevents the production of glycosuria by phloridzin.

In the early part of this year, L. G. Rowntree and J. T. Geraghty published a preliminary report on the use of phenolsulphonethalein in estimating the efficiency of the kidneys.

The total elimination of this drug by the kidneys suggested the possibility of applying this dye in the estimation of the efficiency of the kidneys. The properties of this drug were discovered by Professor Abel in the course of some work with the phenolthalein group of drugs.

Abel and Rowntree have shown that a properly prepared solution of the sodium salt can be used subcutaneously without the slightest evidence of an irritant action; "that the drug can be administered by mouth with no ill effects"; "that the administration of the drug in one-tenth grain doses, or less by mouth, is followed by its appearance in the urine in one hour to an hour and a half"; "that the subcutaneous administration is followed by the appearance of the urine in about ten minutes."

The technique elaborated by Rowntree and Geraghty for the purpose of utilizing this drug as a functional test is described by them as follows:

"A solution of 0.6 gram of phenolsulphonethalein and 0.84 cc. of an 8 per cent solution NaOH are added to 0.75 per cent NaCl solution. This gives the monosodium or acid salt, which is red in color and which is slightly irritant locally when injected. It is necessary therefore to add two or three drops more of the 8 per cent hydroxide in quantities sufficient to change the color to a Bordeaux red. This preparation is non-irritant. One cc. of this solution, containing six mg., is administered subcutaneously in the upper arm by means of an accurately graduated syringe. The time of the injection is carefully noted. A faint pink tinge can be usually noted in about ten minutes if the urine is collected in a vessel containing one or two drops of a 25 per cent NaOH solution. In order to insure a free urinary secretion, it is recommended that 300 or 400 cc. of water be administered about twenty minutes before injecting the drug. We have not found this precaution necessary. If the patient cannot void, as in retention due to an enlarged prostate, a catheter is inserted, and as soon as the reaction is demonstrated, the catheter

is corked and the bladder drained at the end of the first hour and the second hour. If the urine is collected from each kidney by use of the segregator or preferably ureteral catheterization, the amount of the drug excreted by each organ can be estimated. In acid urine the color displayed is yellow or orange, and this immediately gives place to a brilliant purple red upon the addition of an alkali.

"The solution is now placed in a liter measuring flask and distilled water added to make accurately one liter. It is then thoroughly mixed and a small filtered portion taken to compare with the standard, which is used for all these estimations. The standard solution, used for comparison, consists of three mg. of phenolsulphonethalein (or one-half cc. of a solution used for injection) diluted up to one liter and made alkaline by the addition of one or two drops of a 25 per cent sodium hydrate solution.

"This is a purple red solution, retaining its intensity of color for weeks, or for an indefinite period. The one solution therefore serves for an immense number of tests.

"One cup of the Duboscq colorimeter (right) is half filled with this standard solution used for comparison which has just been described, and the plunger lowered so that the indicator reads at 10.

"A varying quantity, depending upon the intensity of the color of the diluted urine, is placed in the other cup and the plunger manipulated until two halves of a field are of an identical intensity of color. The indicator of the left plunger is now read, the fraction, as indicated by the Vernier scale, being taken into account. The estimation of the quantity present is then a question of simple arithmetic.

"For instance, the left side reads at 20, the standard being placed at 10. In other words it takes a column of fluid twice as long to give the same intensity of color as that of the standard, which of course shows that the solution contained only half as much dye.

"To obtain the percentage of dye excreted in the urine, compared with the amount in the standard solution used for comparison, it is necessary to multiply the reading of the standard by 100 and divide by the reading indicated for the solution containing the urine. To return to our example, we have $\frac{10 \times 100}{20}$ equals 50 per cent as much drug in the urine as in the standard solution.

"The three mg. to the liter standard comparison has been chosen arbitrarily because of the beautiful pink color which is obtained when

the indicator stands at 10. The amount of the drug used for injection is 6 mg.

"We have compared the amount of the drug in the diluted urine with that of the standard for comparison, but if we wish to estimate the amount of drug secreted, as compared with the amount of drug administered, we must compare the amount excreted with 6 mg. rather than 3 mg. In the example given above, we must have 50 per cent of the 3 mg., or 25 per cent of 6 mg., which was the amount injected; so that the excretion is 25 per cent of the amount administered.

"With the Duboscq instrument, it is possible to detect a difference of 0.04 mg. of phenolsulphonethalein, the accuracy of the quantity estimated is therefore assured with certainty. Neither the normal coloring matter nor accessory pigment present in the urine, nor the presence of pus, influence the color of the dye. The method is a very sensitive one, the object of the test being to estimate the quantity of the drug excreted.

"The technique of the test is quite simple. The injection is given, the urine is collected for the first hour and for the second hour. To each sample sufficient sodium hydrate is added to insure alkalinity and maximum intensity of color, then the solution is diluted to a liter and a few cc. are filtered, the reading is made, and the per cent of the drug secreted is calculated."

Shortly after my personal interview with Doctor Geraghty, during my visit to Johns Hopkins, in March, 1910, I decided to make a trial of this method at the Montefiore Home. With the assistance of Dr. Kristeller, the resident physiological chemist who made the colorimetric estimations for me, we quote the following:

Our total number of injections were about 70 on 58 subjects. (Some of our early experiments are omitted in this report because the preparation of the solution and the technique employed differed somewhat from that described by Drs. Rowntree and Geraghty.)

SERIES I.

Our first subjects were healthy men. Each received 6 mg. of phenolsulphonethalein subcutaneously with the following results:

D. O. R.	Age 52	67 per cent.
F. R. I.	Age 24	52 per cent.
F. A. W.	Age 25	70 per cent.
N. A. T.	Age 27	66 per cent.
S. L. O.	Age 24	42 per cent.
E. H. R.	Age 23	67 per cent.
K. R. I.	Age 30	50 per cent.
F. R. B.	Age 28	75 per cent.

Healthy Males.
Phenolsulphonethalein .006 g. Subcutaneously.

Case	Age	Amount of drug recovered		
		1st hour per cent	2d hour per cent	Total per cent
D. O. R.	52	..	..	67
F. K. L.	24	..	..	52
F. A. W.	25	..	..	70
N. A. T.	27	..	..	66
S. L. O.	24	..	..	42
E. H. R.	23	50	17	67
K. K. L.	30	48	11	59
F. R. B.	28	51	24	75

Average for 2 hours, 62½ per cent.

Average time for first appearance, 10 minutes.

No reaction in specimens obtained 8 hours after injection of drug.

The average length of time for the first appearance of the dye was 10 minutes. The average per cent of dye recovered at the end of two hours was 62 per cent.

No reaction obtained six to eight hours after injection was given.

The per cent recovered in healthy individuals as reported by Rowntree and Geraghty is 60 to 85 per cent. The slight difference in time of estimation readily accounts for the slight difference obtained in our results. We computed from the time of the subcutaneous injection while in their reports they note from the time that the drug is first demonstrated in the urine.

Two of my cases presented for operation, in the next series, are of sufficient interest to warrant their report somewhat in detail:

CASE I. R. W., woman, age 48, admitted to my service at the Beth Israel Hospital July 4, 1910, with a history of pain of two days' duration in the region of the right hip and flank and radiating to the iliac region; vomiting and chills followed by temperature. She had voided a moderate quantity of urine without pain, six to eight times in twenty-four hours.

Examination revealed marked sensitiveness over both kidney regions, particularly the right kidney, which seemed considerably enlarged. Her temperature was 103°. The urine, specific gravity 1.010, contained a trace of albumen and showed many pus cells microscopically. She had a leucocytosis of 13,600, and polynuclear count of 80 per cent.

Cystoscopy, July 6th. A catheter introduced into the right ureter seemed to meet with an obstruction at about 8 inches and no urine obtained. I also catheterized the left ureter and obtained a fair quantity of clear amber-colored urine which gave a marked reaction to phenolsulphonethalein two hours after a subcutaneous injection of 6 mg. The dye could be detected in the urine for thirteen hours subsequent to its first appearance.

The kidney regions were radiographed and the picture showed a distinct shadow in the right ureter about two inches below the pelvis of the kidney. The left kidney showed three large distinct shadows. It was deemed advisable to first relieve the right kidney from its apparent obstruction.

Operation, July 11th. The right kidney was exposed and delivered. It was found very much enlarged and distended. An incision was followed by the evacuation of

a large quantity of foul purulent urine. The upper portion of the ureter was palpated and a calculus felt about two inches from the pelvis. This calculus was found firmly impacted in the ureter. After its removal, the ureter was sutured and the kidney replaced. Gauze drains were inserted at either angle of the wound and the remainder of the wound sutured.

Two days later phenolsulphonethalein injected subcutaneously was demonstrated on the dressing as well as in the urine from the bladder (showing that the kidney was again functioning).

Functional test, July 26th. Cystoscopy and ureters catheterized; one cc. of the drug solution injected. Reaction of the dye on the addition of solution of sodium carbonate was obtained in 11 minutes from the right kidney after the injection was given. Four cc. of urine were obtained in 30 minutes. From the left catheter only one-half cc. of fluid was obtained during the first thirty minutes, and the dye did not make its appearance for one hour and twenty minutes. During the first two hours only traces of the drug were recovered. During the second two hours 34 per cent of the amount injected were recovered. The fluid from the bladder showed a very slight reaction. The patient had drunk very little fluid for some time previous to the cystoscopy. The catheters were left in situ for two hours and then withdrawn. Phenolsulphonethalein could be demonstrated in all the specimens collected for seven hours. During the first few days the average amount of urine excreted in 24 hours was 30 ounces. After this operation it averaged 43 ounces a day.

August 1st. Patient was again anesthetized and the left kidney exposed and bisected. Three large calculi were found, one occupying the pelvis, while the other two were firmly wedged in the calices of the kidney so as to render the upper two-thirds of the kidney functionless. A smaller abscess, evacuated in the lower pole of the kidney, contained several small calculi. Considerable purulent fluid was also evacuated with the removal of the other calculi. The kidney was replaced and drains inserted and the remainder of the wound sutured. During the second twenty-four hours subsequent to this operation, the patient voided 74 ounces.

October 1st. Functional test. Reaction obtained from the right kidney in ten minutes and from the left kidney in 25 minutes. The amount excreted during the first hour was 21 per cent, and during the second hour 9 per cent, or a total of 30 per cent in two hours.

In our first test we recovered only a trace of the drug from the left kidney during the first two hours, while none was recovered from the right. We were now able to recover traces of the drug as early as 10 and 25 minutes respectively from the right and left, with a total excretion amounting to almost two-thirds of that under normal conditions.

SERIES II.

S. W., female, age 48, married.

July 6, 1910. Functional test, phenolsulphonethalein .006 g. Right kidney negative, left kidney, trace 2 hours.

July 11, 1910. Right nephrotomy and ureterotomy.

July 26, 1910. Functional test phenolsulphonethalein .006 g. Right kidney 11 minutes, left kidney 1 hour and 20 minutes. First two hours only trace recovered; second two hours 34 per cent.

August 1, 1910. Left nephrotomy.

October 1, 1910. Functional test. Phenolsulphonethalein .006 g. Right kidney, 10 minutes; left kidney, 25 minutes.

Amount of drug recovered: 1st hour, 21 per cent; 2d hour, 9 per cent; total, 30 per cent.

As the general clinical condition of the patient progresses, as the profound anemia and pallor disappears, as the function of the kidneys as manifested by the quantity and character of the urine improves, we find the phenolsulphonethalein reaction is proportionately increased.

Had we depended upon the X-ray alone in this case, we would have been induced to operate first on the left kidney. This would undoubtedly have resulted in death of the patient. The cystoscopy and the functional test showed that the recovery of the function of the right kidney was imperative, as the left kidney was not functioning sufficiently.

CASE 2. Mrs. L. For the permission of the report of this case I am indebted to Dr. Ladinski. He had operated on a woman, age 30, on May 4, 1910, at the Beth Israel Hospital, for perforation of the uterus, with sepsis following a curettage by a physician for an incomplete abortion at three and one-half months of pregnancy. The patient had had chills and fever, had vomited, and had complained of pain in the abdomen. She had a profuse, offensive, purulent vaginal discharge. Subsequent to her operation, the patient had a continuous temperature, for several weeks, and developed a pyemic abscess with osteomyelitis of the left foot, which also required operation.

In July the patient complained of pain in the region of the left kidney; her urine contained pus and blood, and I catheterized the ureters on the 15th of July.

Six mg. of phenolsulphonethalein were injected subcutaneously and a reaction obtained from the right ureter in eight minutes. Only one or two drops of thick purulent material were obtained from the other catheter, and then it became clogged and nothing more came out. The urine collected for two hours from the right catheter showed by the Duboscq colorimeter that we had recovered 51 per cent of the drug. This is a fair average for the normal output of two kidneys. The patient was radiographed; the negative showed a large calculus occupying the pelvis of the left kidney with projections into the calices. Several smaller calculi were distributed in various portions of the kidney. The kidney itself appeared considerably enlarged.

July 16th the patient was anesthetized, the left kidney was exposed and found to be very much enlarged and distended, firmly adherent. It was delivered with great difficulty on account of the shortness of its pedicle. The kidney was incised and found to contain a large quantity of foul-smelling purulent fluid. The pelvis was occupied by a large calculus, while the parenchyma contained several abscess cavities with calculi. The entire secretory portion of the organ appeared to be entirely disintegrated. The kidney was removed. The patient has made an uneventful recovery.

The functional test has averaged 52 per cent of the drug in two hours. The test made a few days ago showed that 43 per cent and 10 per cent of the drug were recovered during the first and second hour respectively, or a total for two hours of 53 per cent.

CASE 3. A. L., male, age 19, cigarette maker, was referred to me about one year ago with multiple calculus-pyelonephritis. The kidney was drained and removed

at a secondary operation. Since the removal of the left kidney the boy has returned to his work and has been feeling quite well. His urine is negative. I have tried the functional test on this case several times recently, and he shows an output varying from 52 to 56 per cent.

CASE 4. J. K., a married woman, age 31. The patient complains of cramplike pains off and on for about seven years. At first the pain appeared about once each year. Recently, however, her attacks would come every month or two. These attacks lasted usually twenty-four hours, with pain radiating from the left lumbar region downwards toward the bladder and accompanied by retching, vomiting, and followed by exhaustion.

Her urine during these attacks was acid, sp. gr. 1018, with a trace of albumen, a few hyaline casts and urate and oxalate crystals.

October 31st. Ureters were catheterized. In attempting to pass the catheter into the left ureter, it met with an obstruction at a distance of about one and one-half inches. The right catheter was introduced without any difficulty. With the functional test, a slight pink reaction was obtained from the right catheter in eight minutes, and the same from the left in 18 minutes. The quantity of the drug recovered in one-half hour from the right side was 8.9 per cent, while from the left side, only 1.1 per cent.

The test showed that the right kidney was doing eight times the work of the left.

A radiograph taken showed a dumbbell shaped shadow in the region of the left ureter one and one-half inches from the ureteral orifice.

CASE 5. Mrs. R. B., age 32, was referred to me for cystitis with hematuria, resisting the usual form of treatment. The woman was then in her sixth month of pregnancy.

Cystoscopy revealed an inflamed bladder with a mass occupying the region of the trigonum resembling a polyp. On account of her pregnancy, the operation was deferred until after her delivery. The hematuria persisted. She otherwise had a normal postpartum.

Ten days after delivery, I performed a suprapubic cystotomy and found a large granuloma in the region of the trigonum, which was curetted and cauterized. From the right ureteral orifice, cheesy material was ejected when massage was applied to the abdomen. The ureters were catheterized and the specimens examined bacteriologically, and were found to contain many *T. b. c.*

The infant was taken from the breast and the mother sent to the country. The general condition of the patient was considerably improved. She gained about 35 pounds in weight and the symptoms of hematuria have ceased.

Functional test made in October. First hour; right kidney, 13½ per cent. First hour; left kidney, 9.4 per cent. The bladder fluid contained 4 per cent, a total of 30 per cent recovered.

CASE 6. Mrs. C., age 27, inmate of the Montefiore Home, with an osteomyelitis of pelvic bones, probably originating in the left sacroiliac synchondrosis. She has a sinus leading to the articulation, from which there is more or less seropurulent discharge.

The patient was of the opinion that urine was escaping from this wound. A radiograph did not assist us much in clearing up the origin of the disease.

The ureters were catheterized, no obstruction was found, and the specimens obtained were negative.

Functional test showed a normal output of 49 per cent during the first hour.

An alkaline dressing was applied to the sinus and the discharge did not show any reaction. We think it safe to infer in this instance that this sinus has no direct communication with either kidney or ureter.

CASE 7. L. N., married woman, age 35. History of attacks of renal colic on and off for over two years.¹ She had consulted various dispensaries and was advised to go to the hospital to have a calculus removed from a kidney.

She had passed some gravel in her urine a few days previous to my examination.

July 27th. Functional test. Reaction was obtained on the right side in eight minutes and on the left in three minutes.

The urine, collected from both sides, showed a few blood cells, many pus cells, and a large quantity of urates. A radiograph taken proved negative. Operation was deferred.

The following are a series of cases at the Montefiore Home, whose urine upon repeated examinations has been negative with the exception of the presence of more or less indican:

J. Lippman, age 42, mediastinal tumor. Indicanuria, 59 per cent.

Weisser, age 58, neurasthenia. Indicanuria, 52 per cent. Browitz, age 45, prog. musc. atrophy. Indicanuria, 50 per cent.

Gentzer, age 38, neurasthenia. Indicanuria, 45 per cent. Epstein, age 26, asthma and ch. bronchitis. Indicanuria, 83 per cent.

SERIES III.

The functional tests used heretofore have found their greatest value in surgical conditions of the kidneys, little or no value being ascribed to them in cases of nephritis.

In acute nephritis and in chronic parenchymatous nephritis, normal or excessive permeability has been demonstrated with the dyes heretofore applied.

Our experience with the drug in nephritis leads us to infer that the dye may prove of value in estimating the functional activity in this disease. In a series of cases of chronic parenchymatous nephritis, the results with the test were as follows:

Street, male, age 65, chronic parenchymatous nephritis, complicated with large abdominal tumor; reaction in 20 minutes; first hour, 15½ per cent, second hour, 18 per cent. Total 33½ per cent.

Krewitz, age 12, chronic parenchymatous nephritis, 10 minutes; 25 and 17 per cent.

Segal, age 59, chronic parenchymatous nephritis, 11 min.; 20 and 8 per cent.

Snodowsky, male, age 33; 16 per cent.

Goetoff, male, age 22 (t. b. c.), 5 min.; 1st hour 26 and second hour 15 per cent.

Sachs, male, age 33 (edema), 15 min.; 8 per cent 1st hour.

¹ This case belongs to a group who give a history of attacks resembling renal colic. The urine does not contain albumen but shows quantities of urates and oxalates. Such cases are frequently referred to the surgeon for nephrotomy, and when operated upon nothing is found. The functional test in several of this class of cases showed a diminished elimination of phenolsulphonethalein.

Berkowitz, male, age 67; 40 min.; 1st hour, 25 per cent.

Goldberg, male, age 52; 1st hour, 11 per cent.

Atlas, female, age 53 (cholelithiasis); 15 min.; 1st hour, trace, second hour, 20 per cent.

These results obtained were quite in accord with the clinical condition of the patients.

Chronic Parenchymatous Nephritis.

Case	Sex	Age	Complication	Amt. Drug	Time of Appearance	Amt. Recovered		
						1st Hour	2d Hour	Total
S. T.	Male	52	Abdominal tumor	.006g	20*	15½	18	33½
K. R.	Male	12	1 wk. of treatment	.006g	10	25	17	41
K. R.	Male	12	1 wk. of treatment	.006g	10*	41	8	49
S. E.	Male	59		.006g	11*	20	8	28
S. N.	Male	33	Multiple sclerosis	.006g				16
F. A.	Male	19	Anemia	.006g	5*	26	15	41
S. A.	Male	33	Edema	.006g	15*	8		
B. E.	Male	67		.006g	40*	25		
G. O.	Male	52		.006g		11		
A. T.	Fem.	53	Cholelithiasis	.006g	15*	tr.	20	20

SERIES IV.

ACUTE DIFFUSE NEPHRITIS

Sadie Marcus, acute diffuse nephritis; 1st 2 hours, 15 per cent.

Mrs. Kaplan, acute diffuse nephritis; 1st 2 hours, 19 per cent.

Mrs. Goldberg, acute diffuse nephritis; 1st 2 hours, 22 per cent.

J. Feinberg, subacute diffuse nephritis; 1st 2 hours, 22 and 7.5 per cent; after one week of treatment, 35 and 13 per cent.

Beatrice Garlick, anuria and convulsions, 24 per cent.

Acute Diffuse Nephritis.

Case	Sex	Age	Complication	Amt. Drug	Time of Appearance	Amt. Recovered		
						1st Hour	2d Hour	Total
S. M.	F.	19		.006g	19*			15
M. K.	F.	m/d		.006g				10
M. G.	F.	m/d		.006g				22
J. F.	M.	40	Subacute nephritis	.006g		22	7.2	29½
J. F.	M.	40	1 wk. treatment	.006g		35	13	48
B. G.	F.	16	Anuria with convulsions 24 hrs.	.006g				
M. S.	M.	21	Delirious; albumen 0.3 per cent	.006g		0	0	d'th

* Followed by recovery.

The results of percentage of drug recovered in these cases, compared with the clinical condition noted at the time of the test.

The case of Beatrice Garlick is of special interest.

She had complete suppression of urine with convulsions for over 24 hours, which were relieved after treatment, and the functional test immedi-

ately showed a 24 per cent elimination during the first two hours. This patient made a gradual but positive recovery.

Another case of interest is that of a young man, H. S., age 21, who was ill one month with symptoms of acute nephritis with delirium. His urine was sp. gr. 1.016, with albumen 0.3 per cent. Although he was considered a very sick patient the clinical symptoms did not indicate that they would prove fatal. Functional test on October 25, 1910; no reaction of the phenolsulphonethalein could be obtained. Patient expired.

Here was a case where the doctors in attendance held out a reasonable hope of recovery. The functional test alone disclosed the real hopeless condition of the patient.

The postmortem revealed an acute nephritis on top of a chronic parenchymatous nephritis.

SERIES V.

CHRONIC INTERSTITIAL NEPHRITIS

F. B., cystitis and chronic interstitial nephritis; 18 per cent first hour.

Mrs. O., chronic interstitial nephritis; 14 and 18 per cent.

Meyer Marks, an acute, superimposed on a chronic interstitial nephritis.

October 25th, functional test made and only traces of the drug were recovered during the first and second two hours. The same day that this result was obtained the patient developed uremic convulsions, and recovered only after heroic treatment.

Chronic Interstitial Nephritis.

F. B. M. O. M. M.	Fem. Fem. Male	Cystitis	.006g	..	18	18	32
		Acute nephritis with chronic interstitial	.006g	..	tr.	tr.	*

* Uremic convulsion.

In obstruction of the urinary tract due to enlarged prostate our experience is limited to five cases.

Two of these men, age 68 and 67 respectively, with small amounts of residual urine, showed reaction to the test in fifteen minutes, and 49 and 36 per cent respectively were recovered in two hours.

The third case, with a history of repeated retention and catheterization, showed an output of only 20 per cent.

The other two cases, without retention and without residual urine, excreted 70 and 74 per cent respectively.

Glick, age 60, reaction 15 min., 1st hour, 19 and 20 per cent, 2d hour, total 49 per cent.

Klepper, age 68, reaction 15 min.; 1st hour, 26 and 10 per cent 2d hour; total 36 per cent.

M. S. W., age 63, trace and 20 per cent.

Berkowitz, age 67, 42 and 28 per cent; total 70 per cent.

Weiss, age 65; 35 and 36 per cent; total 74 per cent.

Enlarged Prostate.

Case	Age	Amount of Drug	Time of Appearance	Amount Recovered			
				1st Hour Per Cent	2d Hour Per Cent	Total Per Cent	Total Per Cent
Residual urine:							
G. S.	68	.006g	15	19	20	49	
K. S.	67	.006g	15	26	10	36	
No residual urine:							
B. E.	67	.006g		42	28	70	
W. E.	65	.006g		38	36	74	
Retention and catheterization:							
M. S. W.	63	.006g		trace	20	20	

The results obtained by Geraghty and Rowntree and myself warrant the conclusion that the elimination of the drug goes hand in hand with the elimination of the normal products of metabolism, a fact for which this method is bound to prove of greater value than any other heretofore devised.

Résumé: Phenolsulphonethalein possesses the following advantages:

1. The drug does not readily decompose in solution and can be sterilized by boiling.
2. The dose required is small, one cc. of solution containing .006 g. of the dye.
3. The injection is painless, and is not followed by irritation if the solution is sufficiently alkaline.
4. The drug is excreted entirely by the kidneys.
5. The drug can be demonstrated in the urine in from three to ten minutes after the subcutaneous injection.

6. From 50 to 70 per cent is excreted during the first two hours.

7. The drug lends itself to accurate colorimetric measurement.

8. The quantity of dye recovered in a specimen within a given time is not influenced by the volume of urine.

9. The presence of pus, phosphates, bile, and indican does not interfere with the colorimetric estimation of this drug.

I desire to express my thanks and appreciation to the various members of the attending staff and house staffs of both Montefiore Home and Beth Israel Hospital for the material submitted and kind assistance rendered.

